[Second Edition.]

# PATENT SPECIFICATION

Application Date: Sept. 24, 1926. No. 23,577/26.

281,803

Complete Left: Dec. 1, 1926.

Complete Accepted: Dec. 15, 1927.

PROVISIONAL SPECIFICATION.

## Improvements in and in connection with Sheets, Pellicles, or Films of Cellulose Esters and Ethers, and the Manufacture thereof.

We, HENRY JAMES HANDS, of No. 100, Duke's Avenue, Chiswick, in the County of Middlesex, a British subject, and SPICERS LIMITED, of 19, New Bridge Street, London, E.C. 4, a company registered under the laws of Great Britain, do hereby declare the nature of this invention to be as follows:—

This invention relates to the structural composition of sheets, pellicles, or films prepared from solutions of cellulose esters or ethers and the necessary plasticising substances, such sheets, pellicles, or films being designed to receive a coating of sensitised gelatin or collodion, and to be used for ordinary photographic or for cinematographic purposes.

According to the invention the sheet or film is made denser and slightly less plastic or flexible and with a tighter skin or a skin or closer texture on one side than on the other, the change in density and flexibility being more or less gradual, if the sheet or film be considered in section, from one side to the other. The object of constructing the sheet or film in this way is two-fold, namely, to oppose a compensating resistance to the distorting tension set up by the sensitised gelatin or collodion and so stabilise the film; and to strengthen the sheet or film on the side unprotected by the sensitised gelatin or the collodion. The sheet or film is made in one operation on the ordinary band machine or on the wheel machine still in use, by a method by which two or more film solutions of different composition as regards the proportions and/or kinds of cellulose esters, for example, and plastics, and, if necessary, the solvents employed, are cast or deposited from a casting box completely divided lengthways into sections, which in effect are separate casting boxes (or separate boxes in series could be used) the "spreader" or front part of each separate successive section of the box, which determines the height above the band or wheel-rim of the film solution cast thereon, being higher from the back section to the front, the front being considered as that part of the casting box away from which the band finally travels with the right quantity of solution for the film of the final thickness required. Taking, for example, the case where two film solutions are used in the making of a film of gradually increasing density and decreasing flexibility from surface to surface, the adjustable spreader of the first section of the casting box—which would actually be the lower edge of the division between the two sections of the box—would be set to allow enough solution from the first section to pass under it to make, say, one-third of the whole film. The spreader of the front section of the casting box would therefore be set high enough to allow the solution making one-third the thickness of the film from the first section and, in addition, sufficient solution from the front section to complete the film to pass under it. Thus in this case two streams of solution in contact would issue from the box, the lower stream having a start of some fraction of an inch. The solvents would be evaporated in the ordinary way and what to all appearances was a single film would result. According to the difference in tonicity of the solutions employed, the density and the vapour density of the solvents and so on, there would be more or less diffusion or interspersion from one stream to the other at and beyond the

[Price 1/-]

uniting surfaces of the two streams before the actual set of the film, and these factors could be so controlled as to produce the desired result, namely, a gradual change in density, flexibility, etc., from one side of the film to the other. If cellulose acetate were the principle cellulose ester employed, one or other of the streams of solution could, in one way, be made to produce a relatively tighter and stronger side of the film by the addition of a proportion of nitro-cellulose and a closer and tighter skin by the utilisation of a solvent or solvents and plastics in appropriate proportions giving such effects, particularly with nitro-cellulose. It would be possible also, by the addition of a suitable oil to one or other of the solutions employed to affect in another way the texture of the skin of the film on one side.

Dated the 23rd day of September, 1926.
MARKS & CLERK.

COMPLETE SPECIFICATION.

## Improvements in and in connection with Sheets, Pellicles, or Films of Cellulose Esters and Ethers, and the Manufacture thereof.

We, HENRY JAMES HANDS, of 100, Duke's Avenue, Chiswick, London, W. 4, a British subject, and SPICERS, LIMITED, of 19, New Bridge Street, London, E.C. 4, a company registered under the laws of Great Britian, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to cellulose ester or cellulose ether compositions in the form of sheets, pellicles and films and particularly to sheets, pellicles and films of the compositions in question designed to be coated with light-sensitive compositions for use in ordinary photographic or cinematographic purposes.

One object of the present invention is to provide sheets, pellicles or films adapted to oppose a resistance to the distorting tension set up by coatings, such for instance as sensitised gelatine or collodion, which may be applied subsequently to the film.

The invention consists in the method of forming sheets, pellicles of films of cellulose ester or cellulose ether compositions by the application to a support from which the final product is stripped, in superimposition and in succession, of a plurality of cellulose ester or cellulose ether compositions containing volatile solvents adapted to yield on evaporation of the volatile solvents cellulose ester or cellulose ether compositions differing in mechanical or physical properties, characterised in this that the compositions are applied in substantially immediate succession, that is to say a second or subsequent composition is applied before any portion or any material portion of the solvent has evaporated from the composition first or previously applied.

The invention further consists in apparatus adapted for use in forming sheets, pellicles or films of cellulose ester or cellulose ether compositions comprising a support from which the sheet, pellicle or film may be finally stripped and means for applying to said support, in superimposition and in substantially immediate succession, that is to say a second or subsequent composition is applied before any portion or any material portion of the solvent has evaporated from the composition first or previously applied, a plurality of cellulose ester or cellulose ether compositions containing volatile solvents adapted to yield on evaporation of the solvent compositions differing in physical or mechanical properties.

One form of apparatus in accordance with the invention comprises a support, means for applying in succession to said support cellulose ester or cellulose ether compositions containing volatile solvents and means adapted to secure relative motion between the support and the means for supplying cellulose ester or cellulose ether compositions thereto.

The support may be of the character employed in the known band or wheel machines used in the production of sheets, pellicles or films of cellulose ester or cellulose ether compositions.

Thus, in accordance with the invention, the apparatus may comprise a moving support on to which the cellulose ester or cellulose ether compositions are deposited and from which they may be stripped, a plurality of reservoirs for the compositions extending at right angles

to the direction of travel of the support and each having an aperture adjacent to the support and of a width substantially equal to the width of the sheet or film to be produced, and means whereby the thickness of the body of material delivered to the support from the said reservoirs may be varied.

The means for regulating the thickness of the layer of composition applied may include a spreader associated with a micrometer or other adjusting means or varying the distance between the lower edge of the spreader, and the moving support.

Conveniently, in accordance with the invention, the reservoirs for the material may be so arranged that the spreader or spreaders adapted to operate on one or certain of the compositions may divide the reservoir to which a composition is supplied from successive reservoirs.

For convenience a device of this kind may be described as a "casting box" and the casting box, if designed for the application of two compositions, may in effect constitute a channel the base of which is formed by the moving support while the extreme forward wall of the channel constitutes one of the spreaders, a division member located and extending across the channel forming the spreader for the composition which is first applied to the support.

With each of the spreading elements micrometers or equivalent adjusting devices will be associated.

A construction in accordance with the invention is illustrated by way of example in the accompanying drawings, in which:—

Figure 1 is a front elevation of what may be described as a "double casting box";

Figure 2 is a plan;

Figure 3 is a cross-section, and

Figure 4 is a view in elevation and plan of a detail, namely a bracket for securing the box in position.

In the drawings 1 and 1*a* are side members to which is readily secured a transverse member 2 from which extend two bridge members 3 and 3*a*, the latter being shown broken away. These bridge members connect the transverse member with a bar 4 at the ends of which are located micrometers 5 adapted to bear on abutments fixed relatively to the plane of the endless band acting as a support, indicated by the reference 6. By adjustment of these micrometers the device as a whole may be caused to move about the pivots 7 in the arms 8 which are secured by the brackets 9 to the forward spreader 10 and in this way the distance between the lower edge of the spreader 10 and the band acting as a support may be varied. Between the member 2 and the spreader 10 is located a spreader 11 which is associated with micrometers 12 in the bridge pieces 3 and 3*a*. By the adjustment of these micrometers the distance between the lower edge of the spreader in question and the endless band functioning as a support may be varied.

As will be seen, the spreader in question in effect divides the device into two troughs 13 and 13*a* to which the compositions are supplied by means of tubes 14 and 14*a* opening into the respective troughs.

With a device as illustrated in the drawings the compositions will be supplied to the troughs 13 and 13*a*, the lower edge of the spreader 10 being arranged at a distance from the endless band which is greater than the distance between the lower edge of the spreader 11 and the band. The band being set in motion and the compositions being supplied to the troughs, assuming that the spreader 11 is set to allow enough solution from the trough 13 to pass under the spreader to form, say, one-third of the total thickness of the film, the spreader 10 will be set high enough to allow a sufficient quantity of solution to pass under it to complete the film or, in other words, to form a film of the desired thickness. In this way it will be seen two streams of solution in contact will be supplied to the moving support, the lower stream having a start of a fraction of an inch. The solvents will evaporate in the ordinary way.

According to the difference in concentration or composition of the solutions employed, the density and the vapour density of the solvents and so on, there will be more or less diffusion or interspersion from one stream to the other at and beyond the uniting surfaces of the two streams before the actual set of the film, and these factors may be so controlled as to produce the desired result, namely a gradual change in density, flexibility, etc., from one side of the film to the other. If cellulose acetate were the principal cellulose ester employed one or other of the streams of solution could in one way be made to produce a relatively tighter and stronger side of the film by the addition of a proportion of nitrocellulose and a closer and tighter skin by the utilisation of a solvent or solvents and plastifiers in appropriate proportions, giving such effects particularly with nitrocellulose or mixtures of nitrocellulose and other cellulose esters or mixtures of cellulose esters

other than nitrocellulose or grades of such cellulose esters. It would be possible also, by the addition of suitable oils, gums, gum resins, esters gums, casein or other materials to one or other of the solution employed, to affect in another way the texture of the skin of the film on one side.

While the above description refers to the production of sheets, pellicles or films, the opposite faces of which possess different mechanical or physical properties, the invention extends to sheets, pellicles or films of compositions of the character specified, the opposite faces of which possess similar mechanical or physical properties while the material between the opposite faces varies in a gradual or progressive manner in respect to its properties, and to sheets, pellicles or films generally exhibiting a gradual or progressive variation in the constitution or mechanical or physical properties of the material between their opposite faces.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is :—

1. The method of forming sheets, pelicles or films of cellulose ester or cellulose ether compositions by the application to a support from which the final product is stripped, in succession, of a plurality of cellulose ester or cellulose ether compositions, containing volatile solvents adapted to yield on evaporation of the volatile solvents cellulose ester or cellulose ether compositions differing in mechanical or physical properties, characterised in this that the compositions are applied in superimposition and in substantially immediate succession, that is to say a second composition is applied before any portion or any material portion of the solvent has evaporated from the composition first applied.

2. The improved method of forming sheets, pellicles or films of cellulose ester or cellulose ether compositions, substantially as hereinbefore described.

3. Apparatus adapted for use in forming sheets, pellicles or films of cellulose ester or cellulose ether compositions by the methods claimed in Claims 1 and 2, comprising a support from which the sheet, pellicle or film may be finally stripped and means for applying to said support in superimposition, and in substantially immediate succession, that is to say a second or subsequent composition is applied before any portion or any material portion of the solvent has evaporated from the composition first or previously applied, a plurality of cellulose ester or cellulose ether compositions containing volatile solvents adapted to yield on evaporation of the solvent compositions differing in physical or mechanical properties.

4. Apparatus as claimed in Claim 3, comprising a support, means for applying in superimposition and in succession to said support cellulose ester or cellulose ether compositions containing volatile solvents and means adapted to secure relative motion between the support and the means for supplying cellulose ester or cellulose ether compositions thereto.

5. Apparatus adapted for use in forming sheets, pellicles or films as claimed in Claim 4, comprising a moving support on to which the cellulose ester or cellulose ether compositions are deposited and from which they may be stripped, a plurality of reservoirs for the compositions extending at right angles to the direction of travel of the support and each having an aperture adjacent to the support and of a width substantially equal to the width of the sheet or film to be produced, and means whereby the thickness of the body of material delivered to the support from the said reservoirs may be varied.

6. Apparatus adapted for use in forming sheets, pellicles or films as claimed in Claim 5 in which the means for regulating the thickness of the layer of composition applied includes a spreader associated with a micrometer or other adjusting means for varying the distance between the lower edge of the spreader and the moving support.

7. Apparatus adapted for use in forming sheets, pellicles or films as claimed in Claims 3 to 6 in which the reservoirs for the material may be so arranged that the spreader or spreaders adapted to operate on one or certain of the compositions may divide the reservoir to which a composition is supplied from successive reservoirs.

8. Apparatus adapted for use in forming sheets, pellicles or films, substantially as hereinbefore described and as illustrated in and by the accompanying drawings.

Dated this 1st day of December, 1926.

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Abingdon: Printed for His Majesty's Stationery Office, by Burgess & Son.
[Wt. 56A.—125/10/1928.]

2nd Edition

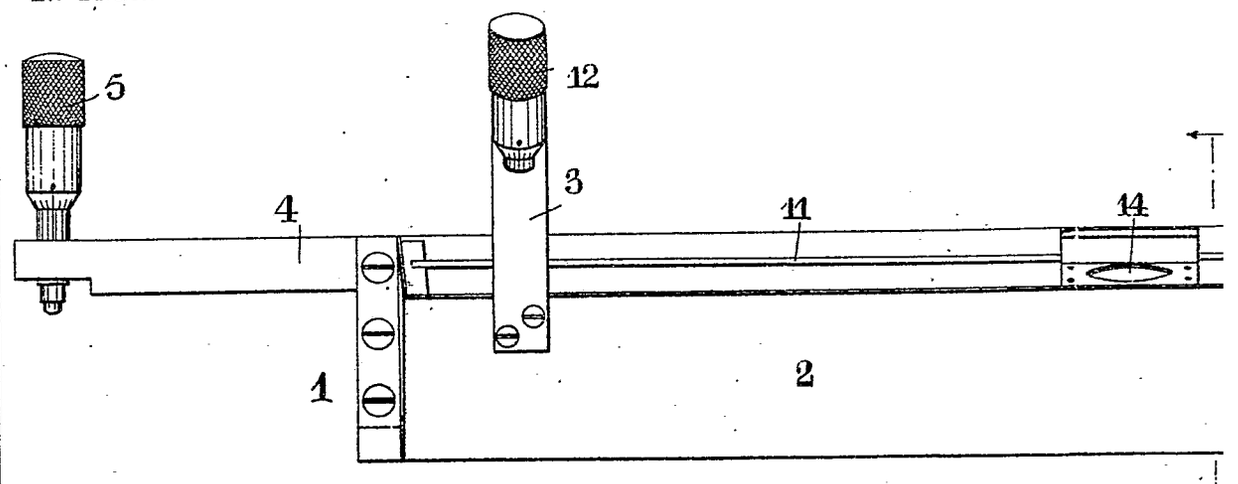



Fig. 1.

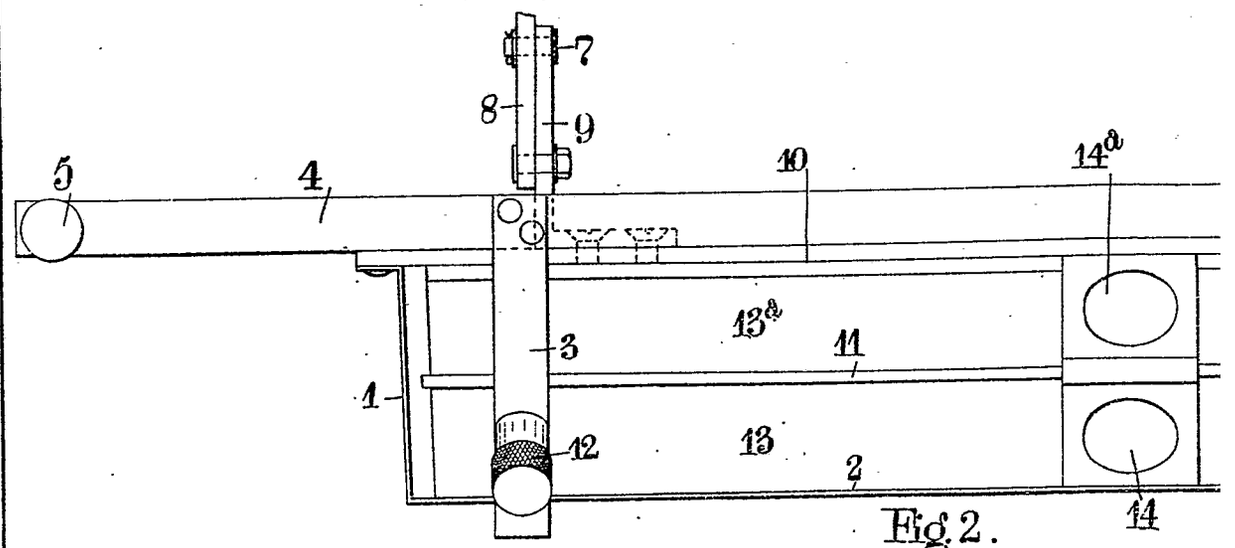



Fig. 2.

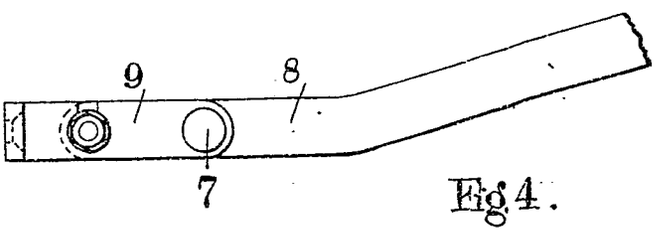
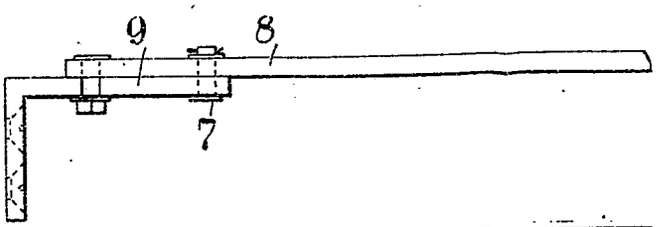



Fig. 4.

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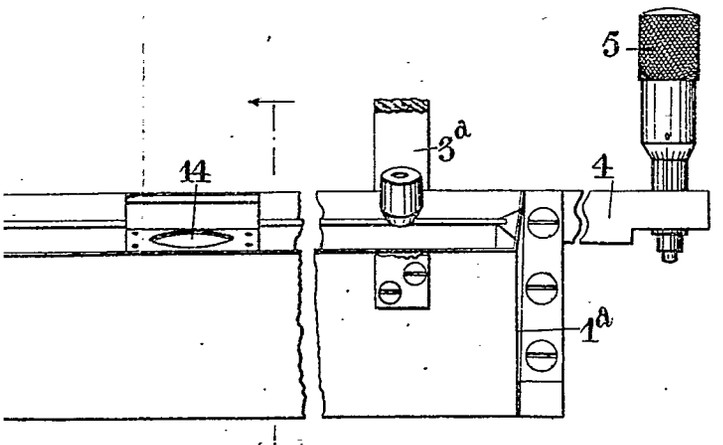


Fig.1.

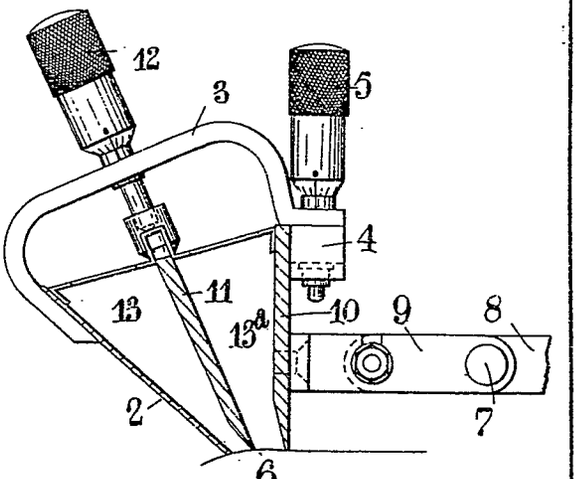


Fig.3.

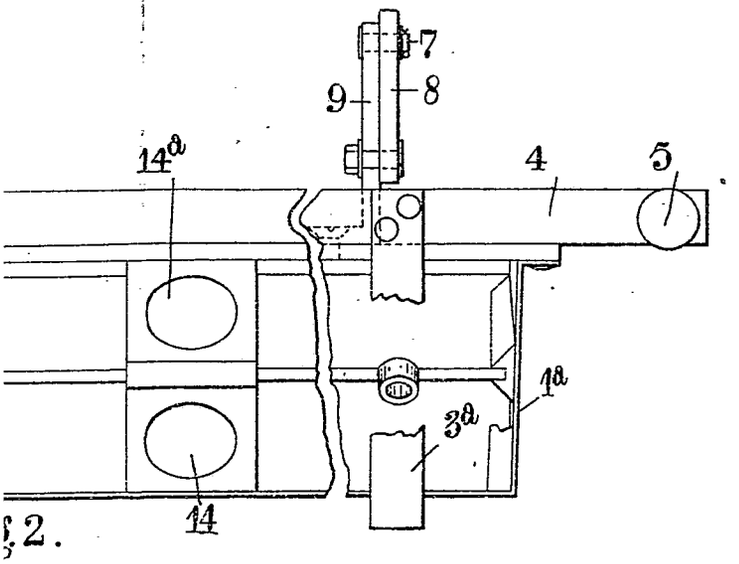


Fig.2.

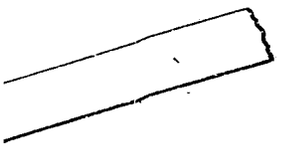

Fig.4.

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281,803 COMPLETE SPECIFICATION

1 SHEET

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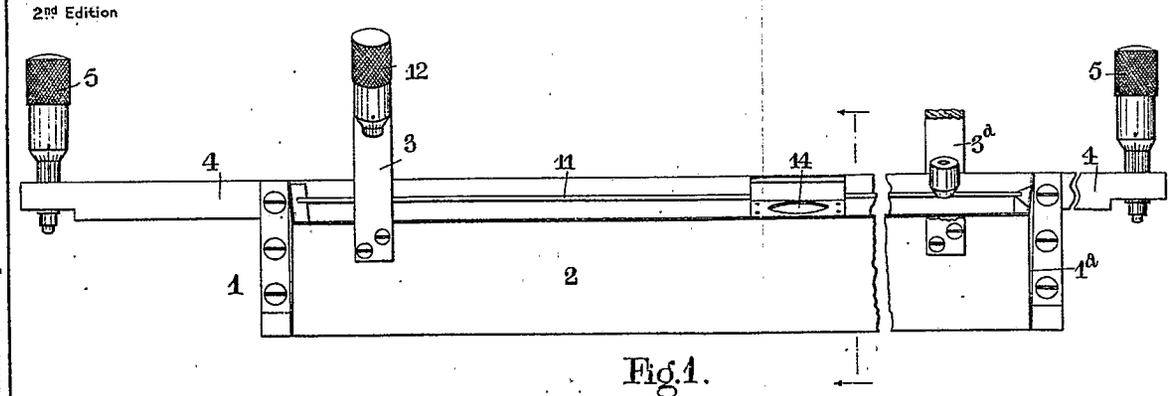



Fig.1.

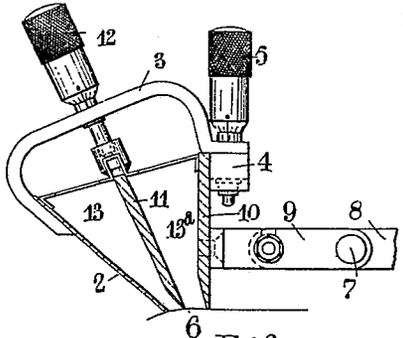



Fig.3.

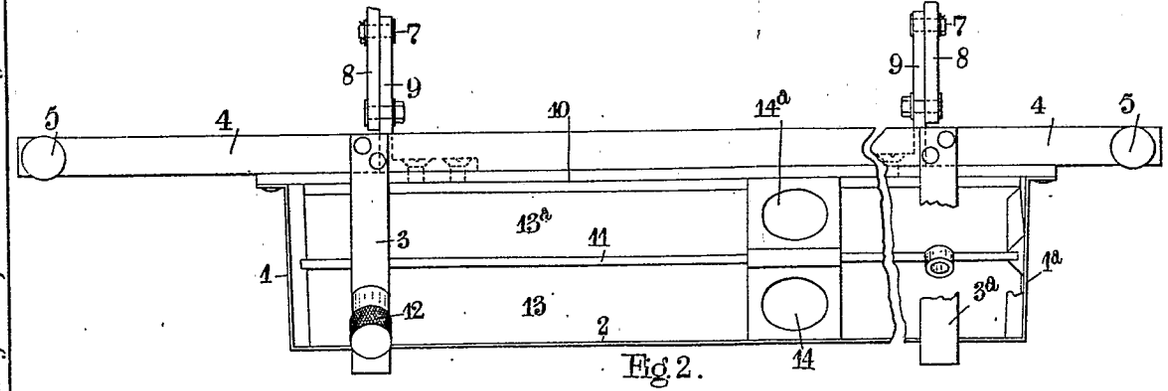



Fig.2.

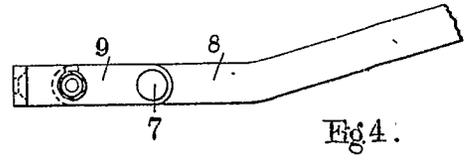
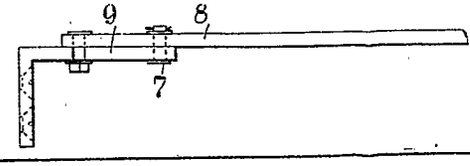



Fig.4.

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